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GENERAL DYNAMICS | CONVAIR

Report No. 8926-089

Materials - Adhesives - Structural - EC 1290 and  
AF-10 (Minnesota Mining and Manufacturing Co.)

Skydrol 500 Hydraulic Fluid Resistance

A. F. Hooper, J. C. George, E. E. Keller

18 December 1958

Published and Distributed  
under  
Contract AF33(657)-8926



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Abstract

Six 2024-T3 aluminum alloy panels, pre-treated with Alodine 600 surface treatment (American Chemical Paint Co., Ambler, Penna.), were spray coated with EC 1290 Scotchweld primer (Minnesota Mining and Manufacturing Co.), pre-cured at 150°F for 1/2 hour, cured at 320°F for one hour and immersed in Skydrol 500 hydraulic fluid. Slight softening of the EC 1290 occurred after twelve days immersion at ambient temperature. Additional softening was not observed during eighteen additional days of immersion.

Tensile shear and peel test specimens prepared in accordance with Specification Mil-P-5090B and using the EC 1290 primer and AF-10 adhesives were immersed in Skydrol 500 hydraulic fluid for thirty days at ambient temperature. At the end of thirty days immersion tension shear and peel strength tests were made. These tests showed that the Skydrol 500 hydraulic fluid had no significant deleterious effect upon the adhesive bonded joints.

Reference: Hooper, A. F., George, J. C., Keller, E. E.,  
"Skydrol 500 Hydraulic Fluid Resistance of  
EC 1290 Scotchweld Prime & AF-10 Adhesive  
Bonded Joints," General Dynamics/Convair  
Report MP 58-371, San Diego, California,  
18 December 1958. (Reference attached.)

## SAN DIEGO

## STRUCTURES & MATERIALS LABORATORIES

REPORT NY 68-371

DATE 18 December 1958

MODEL 22

# TITLE

REPORT NO. MP 58-371

SKYDROL 500 HYDRAULIC FLUID  
RESISTANCE OF EC 1290 SCOTCHWELD  
PRIME & AF 10  
ADHESIVE BONDED JOINTS

MODEL: 22

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NO. OF PAGES 4

NO. OF DIAGRAMS 2

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## REVISIONS

[illegible]

**ANALYSIS**

PREPARED BY Cooper

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REVISED BY

**C O N V A I R**A DIVISION OF GENERAL DYNAMICS CORPORATION  
SAN DIEGOPAGE 1  
REPORT NO. MP 58-371  
MODEL 22  
DATE 12-18-58**INTRODUCTION:**

Skydrol 500 hydraulic fluid is a phosphate ester which has a high solvency power on many organic materials. Therefore, Engineering Design requested that test work be performed to determine the Skydrol 500 hydraulic fluid resistance of the AF 10 adhesive bonding system.

**OBJECT:**

1. To determine the Skydrol 500 hydraulic fluid resistance of cured EC 1290 Scotchweld prime.
2. To determine the Skydrol 500 hydraulic fluid resistance of AF 10 adhesive bonded joints.

**CONCLUSIONS:**

1. The Skydrol 500 hydraulic fluid very slightly softened the cured EC 1290 Scotchweld prime after twelve (12) days immersion at ambient temperature. No additional softening occurred after an additional eighteen (18) days immersion.
2. Skydrol 500 hydraulic fluid had no significant deleterious effects on the tensile shear and peel strength of AF 10 adhesive bonded joints after thirty (30) days immersion at ambient temperature.

**TEST SPECIMENS:**

Six (6) 4 x 10 inch bare 2024-T3 aluminum alloy panels, with alodine 600 surface treatment, were Scotchweld primed in accordance with Convair Specification 22-00010. The Scotchweld primed panels were precured at 150°F. for 1/2 hour and fully cured at 320°F. for one hour.

Forty (40) tensile shear specimens were prepared in accordance with Specification Mil-A 5090 B, Figure 3, using the AF 10 adhesive system for bonding.

Twenty (20) peel strength specimens were prepared in accordance with Convair Peel Strength Specification 8-07310 using the AF 10 adhesive system for bonding.

**TEST PROCEDURE:**

The six (6) Scotchweld primed specimens were exposed to Skydrol 500 hydraulic fluid for 30 days. Three (3) specimens were immersed and three (3) specimens were wetted intermittently. The specimens were inspected at 24 hour intervals for any deleterious effects during the test period.

## ANALYSIS

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## CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION  
SAN DIEGO

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TEST PROCEDURE: (Continued)

Twenty-eight (28) of the forty (40) tensile shear specimens were immersed in Skydrol 500 hydraulic fluid. These specimens were removed from Skydrol 500 in groups of four (4) after immersion. A group was removed after 1, 5, 10, 15, 20, 25 and 30 day (s) and tested for tensile shear strength. The twelve (12) remaining specimens were divided into three (3) groups of four (4) specimens each and tested as controls. One group was tested with the immersed specimens after one (1) day, one group after fifteen (15) days, and one group after thirty (30) days.

Fourteen (14) peel strength specimens were immersed in Skydrol 500 hydraulic fluid, and were removed in groups, two (2) specimens per group, at 1, 5, 10, 15, 20, 25, and 30 day (s) for testing. The six remaining specimens were tested in three (3) groups of two specimens each as controls at 1, 15, and 30 day (s).

RESULTS:

Skydrol 500 hydraulic fluid had slightly softened the cured EC 1290 Scotch-weld prime after twelve (12) days immersion. No additional softening occurred after an additional eighteen (18) days immersion.

The tensile shear and peel strength data for the AF 10 adhesive bonded system are tabulated in Tables I & II, respectively.

DISCUSSION OF RESULTS:

Skydrol 500 hydraulic fluid has no significant deleterious effects on the tensile shear and peel strength after 30 days immersion at ambient temperature. The tensile shear strength of the 30 day control and 30 day immersion specimens are low, but the strength values are well above the minimum strength values of 2500 PSI for the AF 10 adhesive bonded joint system (MPS 16.14). The reduction in tensile shear strength of these specimens was attributed to geometrical difference in specimen fabrication. These tensile shear strength values are within the 10% tensile test error margin.

The Skydrol 500 hydraulic fluid plasticized the cured AF 10 tape flash after 5 days immersion. No Skydrol 500 hydraulic fluid penetrated the glue line on tensile shear or peel test specimens during the 30 days immersion. Therefore, no significant affect would be expected on the tensile shear or peel strength values.

NOTE: The data from which this report was prepared are recorded in Engineering Test Laboratory Data Book No. 9840.

TABLE I  
 TENSILE SHEAR STRENGTH DATA (PSI)

Specimen No.	1 day <sup>a</sup>	5 days	10 days	15 days	20 days <sup>*</sup>	25 days	30 days <sup>*</sup>
1	4450	4780	5290	4920	4720	4890	3510
2	4580	4900	5100	4880	3920	5310	3080
3	4620	5050	4600	4940	5060	5000	3330
4	5250	4970	4780	5100	4710	5440	4010
Average	4725	4925	4942	4960	4602	5137	3492

  

Control Spec. No.	1	2	3	4	Average
	4430	4920	4930	5160	4860
	4400	4000	4880	4900	4555
	3530	3710	4310	3450	3750

\*Note: Control Specimens tested on above days



TABLE II  
 PEEL STRENGTH DATA (lbs)

Specimen No.	1 day	5 days	10 days	15 days	20 days	25 days	30 days
1	50	62	62	58	56	62	58
2	54	61	58	58	64	60	60
Average	52	61.5	60	58	60	61	59

Control Specimen No.

1	50	54	60
2	52	56	62
Average	51	55	61

\* Note: Control Specimens tested on above days